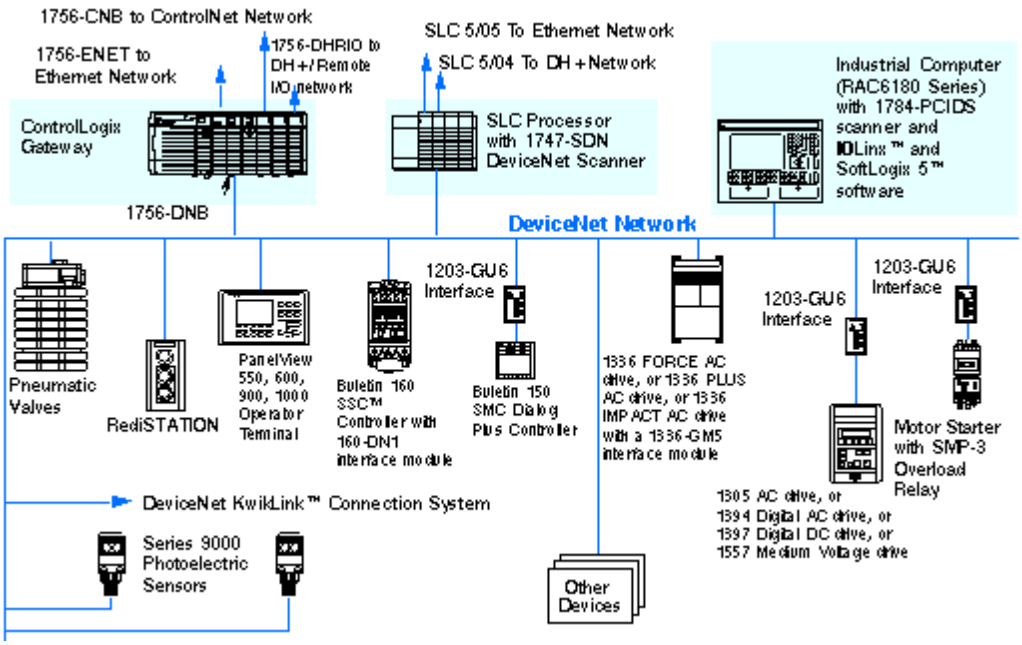
DATALOGIC

Your Life. Our Enthusiasm™

April 2005

DeviceNet



SERVICE GUIDE

COMPANY CONFIDENTIAL

DEVICENET Service Guide

INDEX

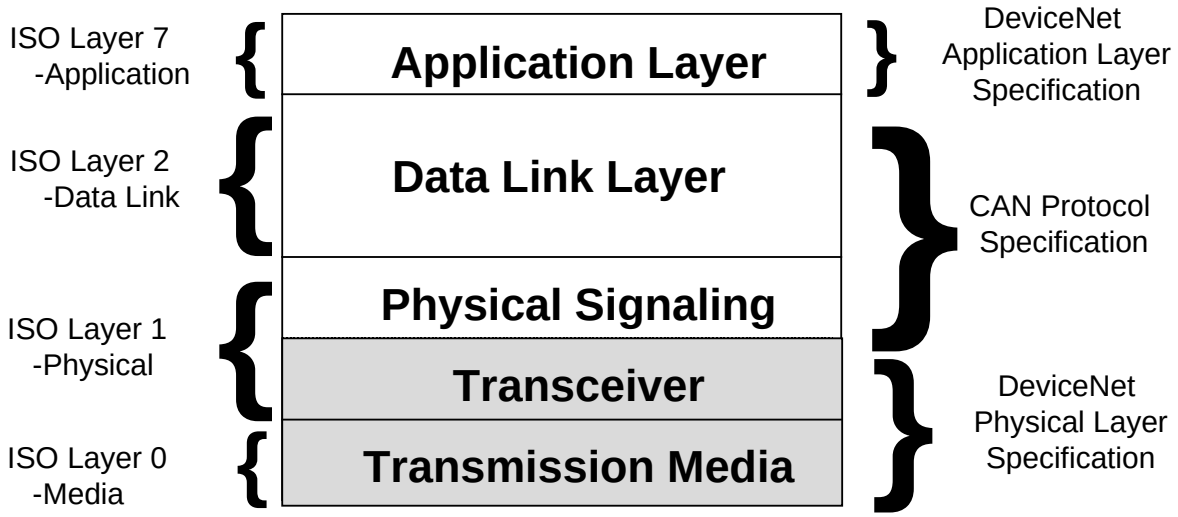
1. Description

1.1 Introduction

What is DeviceNet?

- DeviceNet is one of the world's leading device-level networks for industrial automation.
- DeviceNet is an open network standard that provides economical and simple means to link INDUSTRIAL devices.
- DeviceNet is based on CAN (Controller Area Network) technology originally developed by BOSCH to replace expensive wire harnesses with low cost network cable in automotive applications. Because the CAN system has fast response and high reliability, it has been used for applications as demanding as control of anti-lock brakes and air bags.
- DeviceNet has high noise immunity, and the communication electronics are available with wide temperature ranges, making the protocol desirable for industrial and process automation. Plug-in connectors are readily available for heavy wash down, general purpose environments.
- Power and signal are carried over the four-wire network. Each device has its own address and it may have several I/O points. Any discrete or analogue instruments may be connected into the network provided it has a CAN chip and other support electronics along with proper firmware to be fully DeviceNet compatible. Passive field devices may also connect into the network via StoneL DeviceNet VCTs and I/O modules, which have provisions for auxiliary inputs and outputs

1.2 Physical Layer

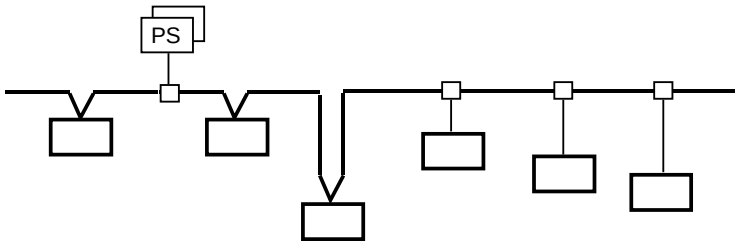


- Use of CAN technology
- Trunk line, drop line configuration
- Node removal without breaking trunk line
- Up to 64 addressable nodes
- Signal and 24Vdc Power in same cable
- Selectable Data Rates (125k, 250k, 500k)
- Both Sealed and Open-Style connections (zero node separation)
- 121 ohm terminator at each trunk line end

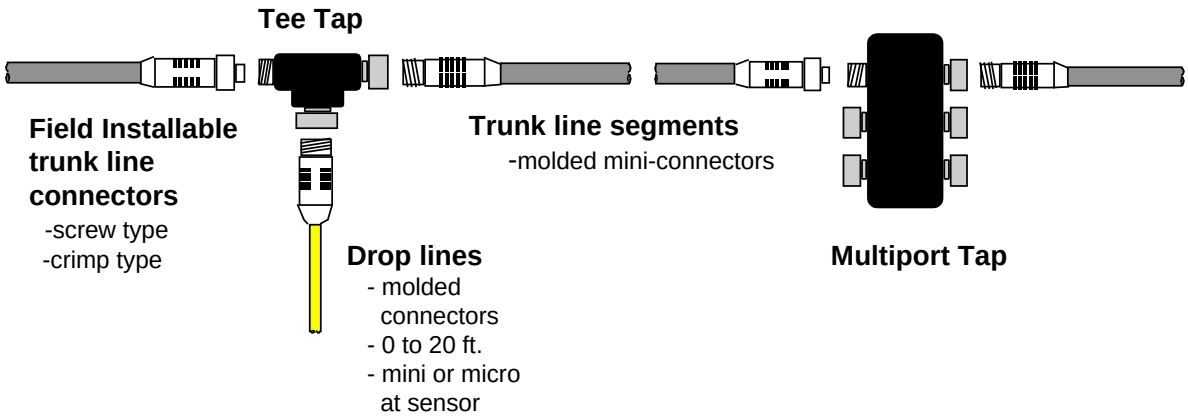
Data Rate	Trunk Distance (thick cable)	Drop Length	
		Max drop	Cumulative
125K	**500m** (1640 ft)	**6m** (20 ft)	**156m** (512 ft)
250K	**250m** (820 ft)	**6m** (20 ft)	**78m** (256 ft)
500K	**100m** (328 ft)	**6m** (20 ft)	**39m** (128 ft)

1.2.1 Power and signals

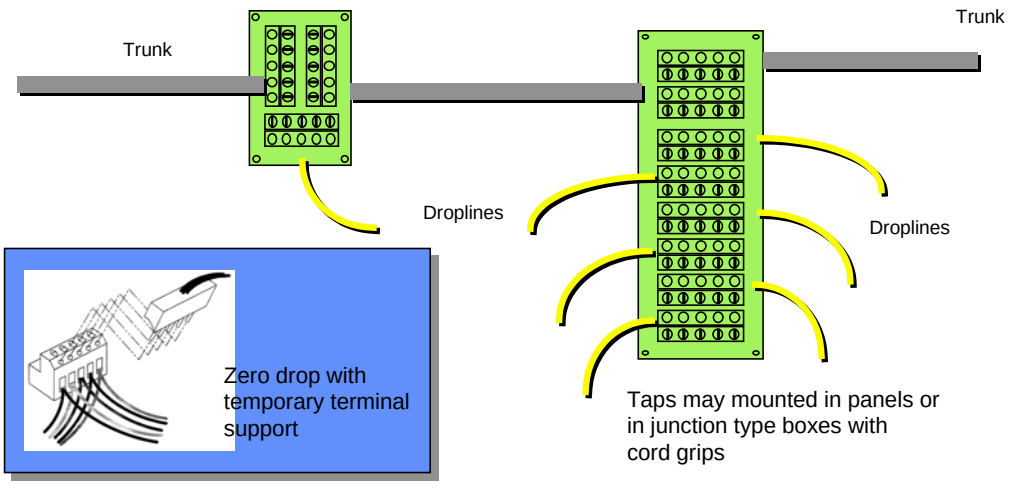
- Two twisted pair
  → Signal pair: low loss, high velocity with foil shield
  → Power pair: up to 8A capacity with foil shield (Note: Class II NEC Code limits current to 4A on any segment)
  → Overall braid with drain wire
- Sensors can be powered direct from bus
- Opto-isolation for self powered devices (→ e.g. drive, PLC, weigh scale, etc.)
- Multiple power supplies can be used (→ used for additional power or as back-up)



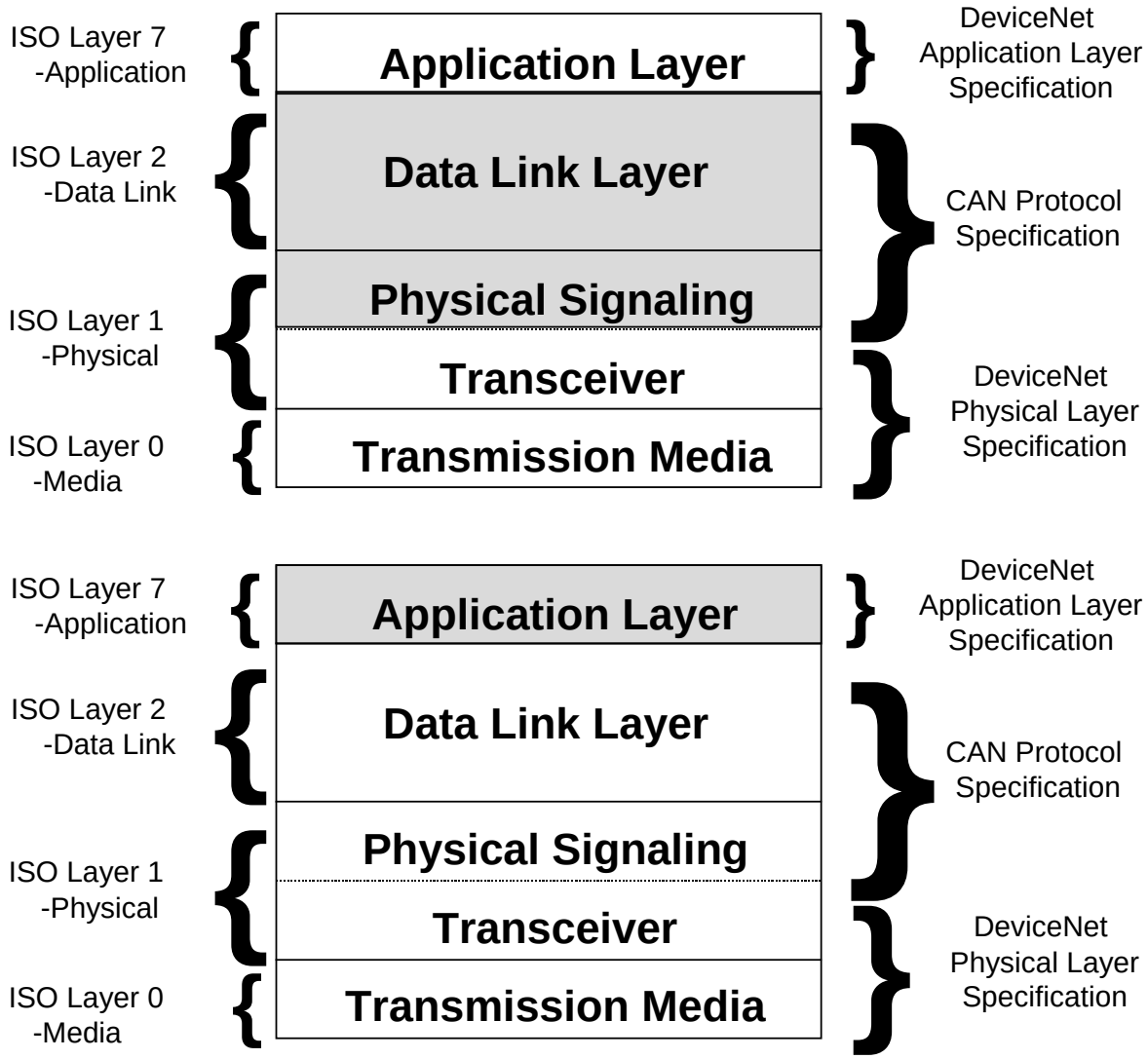
1.2.2 Typical Sealed-Style Taps



1.2.3 Typical Open-Style Taps



1.3 CAN in the Stack / Application Layer



For information about these application layers and further DeviceNet details, please refer to the ODVA official site (www.odva.org).

1.4 Datalogic Devices

Currently DeviceNet is supported by the following devices:

DS6300-100-015 Linear	(931351040)
DS6300-105-015 Oscillating Mirror	(931351090)
DS6400-100-015 Linear	(931351099)
DS6400-105-015 Oscillating Mirror	(931351109)
DS6500-100-015 Medium Range Linear	(931401008)
DS6500-105-015 Medium Range Osc. Mirror	(931401018)
DS6500-200-015 Long Range Linear	(931401009)
DS6500-205-015 Long Range Osc. Mirror	(931401019)
CBOX-400 Connection Box	(93A301010)
CBOX-410 Connection Box with display	(93A301040)
SC6000-1215 Universal Controller Eth+DNet	(935701002)

2. Service Guidelines

2.1 DS6300-X0X-015 DeviceNet Application Note for ControlLogix

This chapter will cover DS6300-X0X-015 and RSNetworx settings to connect a 6K Family scanner with integrated DeviceNet to a network Mastered by a 1756-DNB module.

It is intended to be used along with its accompanying ladder logic, scanner configuration, and DeviceNet files as a demonstration of DeviceNet connectivity.

IMPORTANT NOTE:
6K devices need 24Vdc from the DeviceNet network in order to operate correctly.

Full programming steps are as follows:

1 - provide 24Vdc from DeviceNet bus (form M12 connector in device base)
2 - power on the DS6x00 reader (typically powered with a separate power supply)
3 - connect to Genius
4 - modify the configuration (Address, BaudRate, Inputarea, OutputAreaSize)
5 - remember to check Parameters_Updating parameter
6 - send configuration to the reader
7 - wait the program restart and the DeviceNet card updating

Do Steps 1, 2 and 3 then proceed with next paragraph *2.2 DS6300 Settings*.

2.2 DS6300 Settings

This section covers settings that will affect the DS6300's behaviour on DeviceNet.

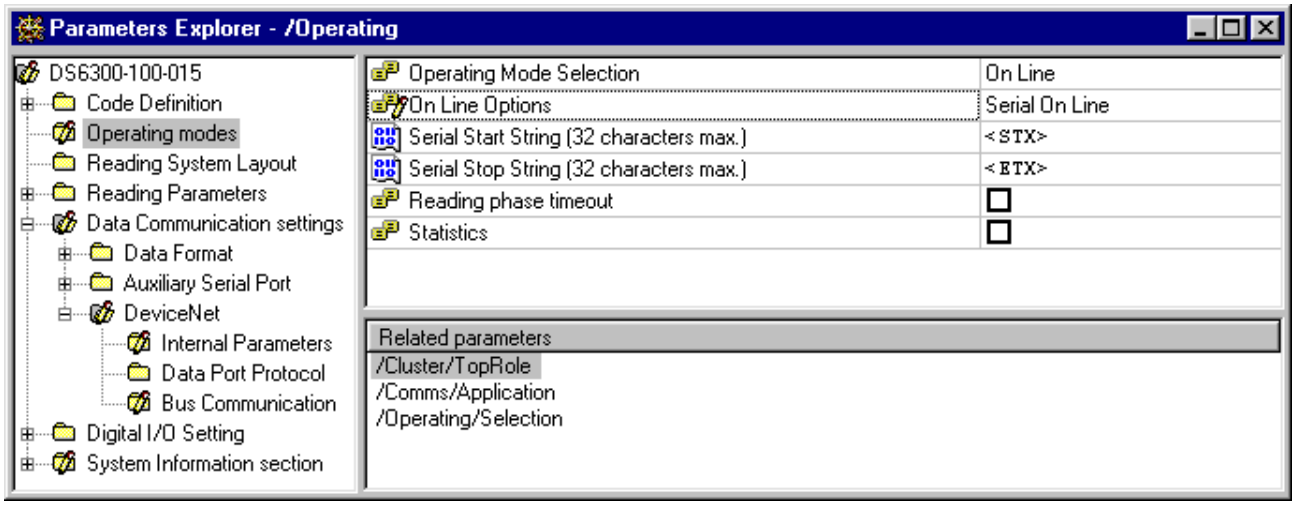


Fig. 1

Connect to the scanner and open the **Operating Modes** tab. (Fig. 1)

The following choices are available:

- **Operating Mode Selection**

This should be set to On Line for triggering the scanner discreetly or via DeviceNet.

- **On Line Options**

This should be set to Serial On Line for DeviceNet triggering.

- **Serial Start String**

Should be set to <STX>

- **Serial Stop String**

Should be set to <ETX>

- **Reading Phase Time Out**

Should be left unchecked. It is easier to let the ControlLogix control the reading phase.

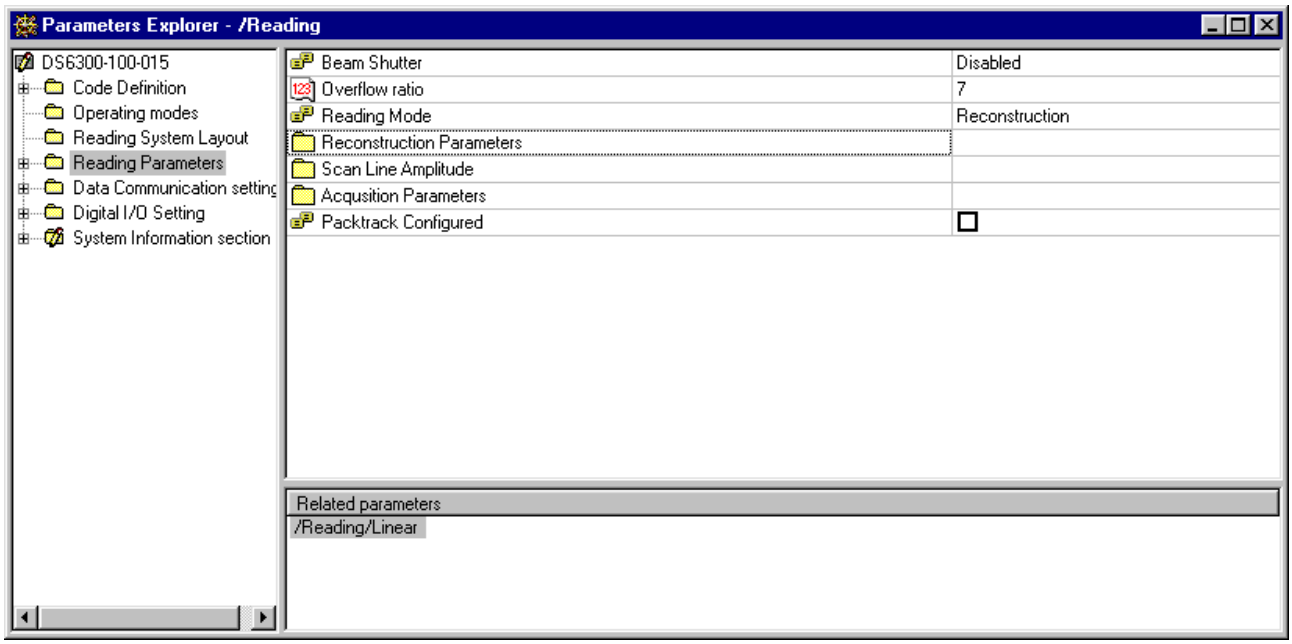


Fig. 2

Move to the **Reading Parameters** Tab (Fig. 2)

- **Beam Shutter**

Disable as default, means that the laser beam stays always on.
If you wish, set this parameter to Triggered so you can see when the reading phase start simply having a look at the laser light.

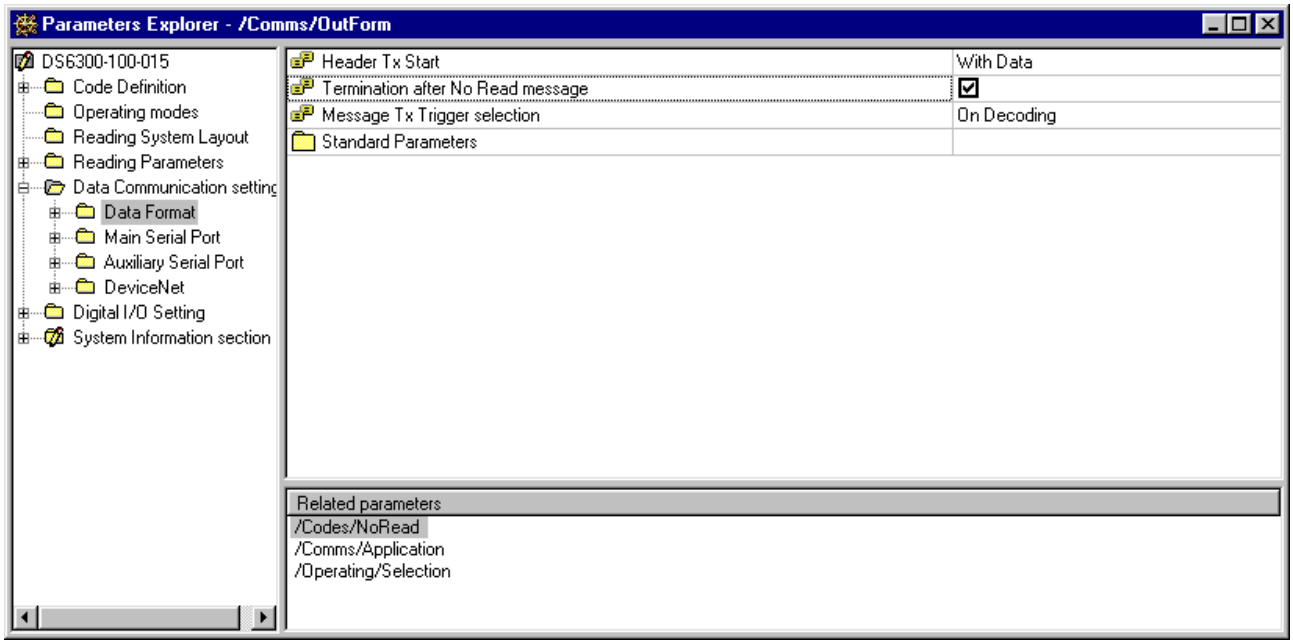


Fig. 3

Move to the **Data Format** Tab (Fig. 3)

- **Header Tx Start**

Set this to With Data.

- **Termination after No Read message**

Should be checked

- **Message Tx Trigger Selection**

Should set to On Decoding

- **Format Type**

Should set to Standard

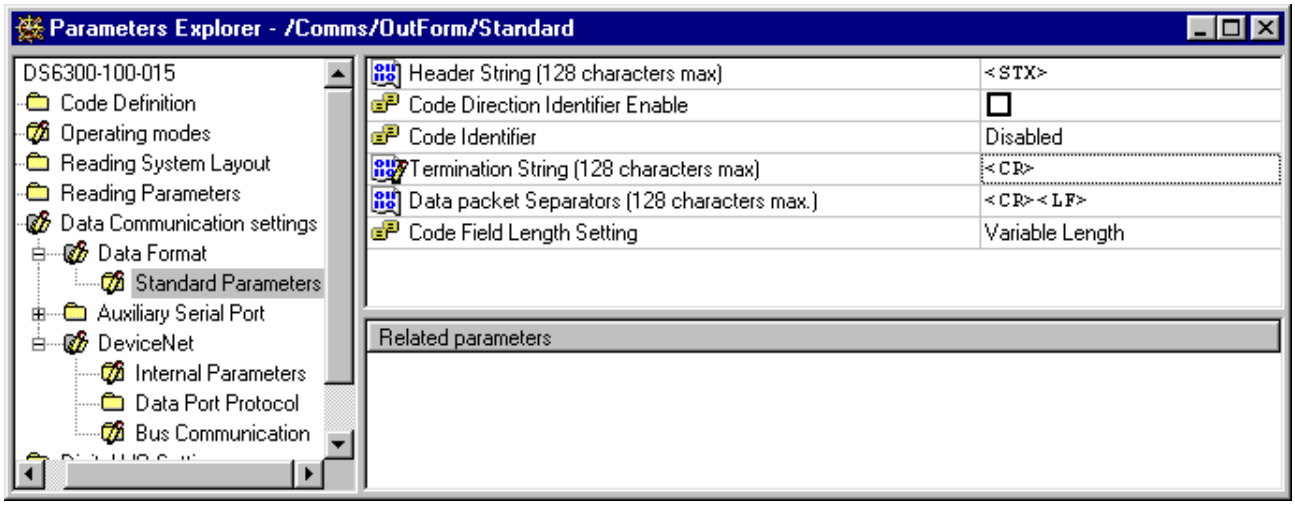


Fig. 4

Move to the **Data Format Standard Parameters Tab** (Fig. 4)

- **Header String**

Set this to <STX>

- **Code direction identifier enable**

Should be unchecked

- **Code identifier**

Disabled

- **Termination String**

<CR>

Note: this must be equal to the Termination Char Value set among DeviceNet parameters.

- **Data Packet Separator**

This doesn't care while single label reading.

Set this to <CR><STX> on multilabel applications. The DS6300 will then transmit each code separately.

- **Code Field Length**

Variable Length

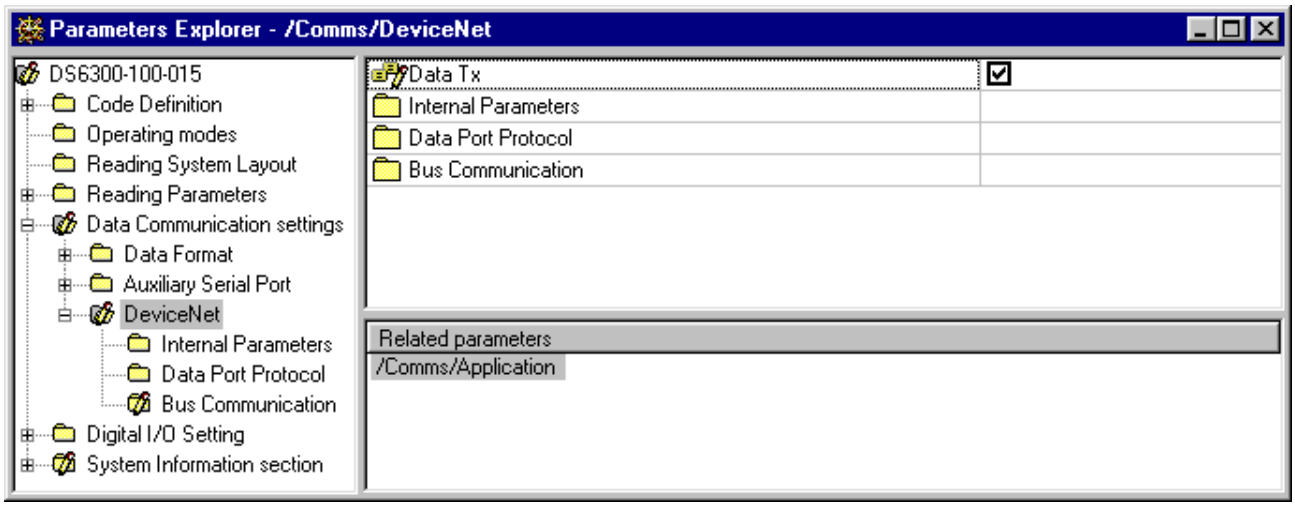


Fig. 5

Open the **DeviceNet Tab** (Fig. 5) make sure the Data Tx tab is checked.
This tells the scanner to send data to the DeviceNet channel.

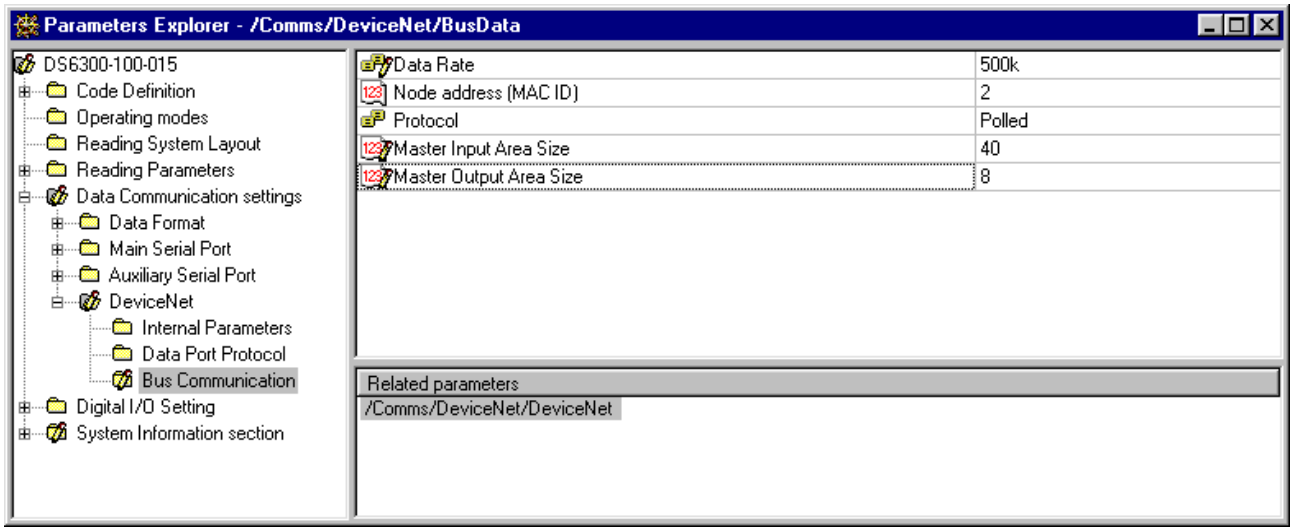


Fig. 6

Open the **Bus Communications Tab** (Fig. 6).

- **Data Rate**

The DeviceNet Baud rate for the system
- 125K is the most common baud rate
- 250K and 500K are the other choices

- **Node Address**

The Node number of this scanner. 0-63
0 is typically the DeviceNet Master (1756=DNB) and 63 is reserved for a PC DeviceNet card such as a 1784-PCD or PCIDS card.
This is not a rule; the master can be at any node number.

- **Protocol**

The only mode that is currently available to use for this device is the Polled Mode.
A DeviceNet master can address slaves using any combination of protocols simultaneously. Defining our device as polled does not affect any other slaves on the network.

- **Master Input Area Size**

The size of the consumed image.

- **Master Output Area Size**

The size of the produced image.

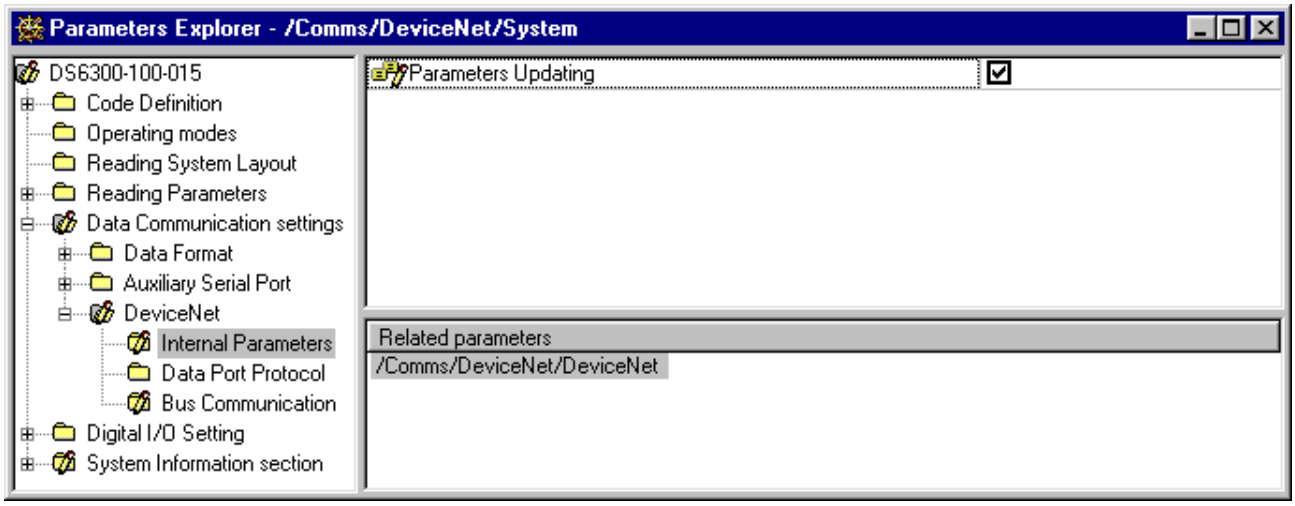


Fig. 7

Open the **Internal Parameters Tab** (Fig. 7).

Check the check **Parameters Updating** box. Send Permanently.
The scanner is now in a mode where it downloads DeviceNet parameters to its internal DeviceNet card every time it boots. It is a quite long boot.

We only need to wait the completion of the process. When the configuration is downloaded successfully, box will be uncheck automatically and DeviceNet card is aligned to the values set.

Any further changes made to the DeviceNet parameters must be downloaded with the box checked for them to take effect.

2.3 DeviceNet Network Setup

Start RSNetworx and browse the network.
The DS6300-X0X-015 should appear as an unrecognized device. (Fig. 8)

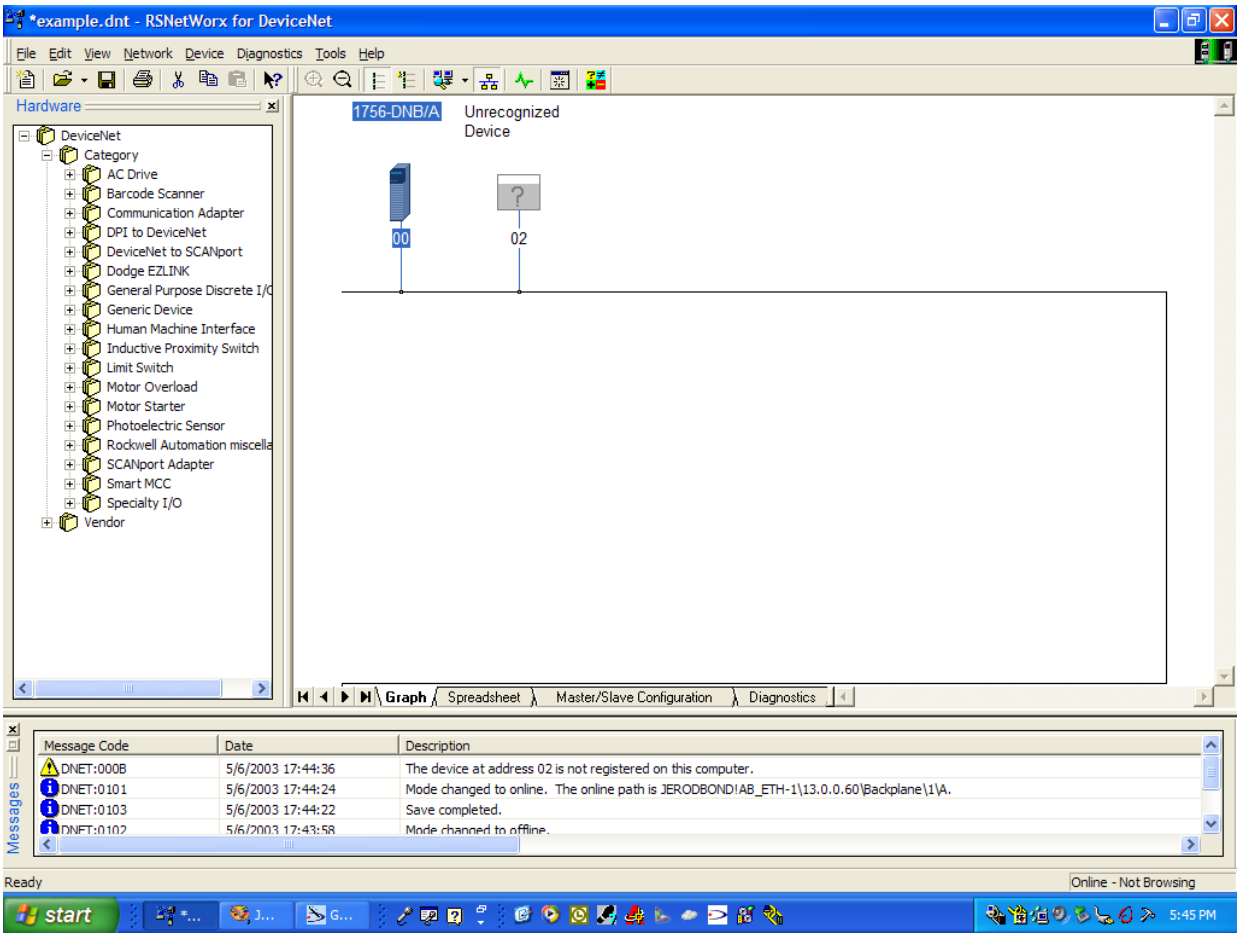


Fig. 8

2.3.1 Register the DS6300-X0X-015

Right Click and choose Register Device. (Fig. 9)

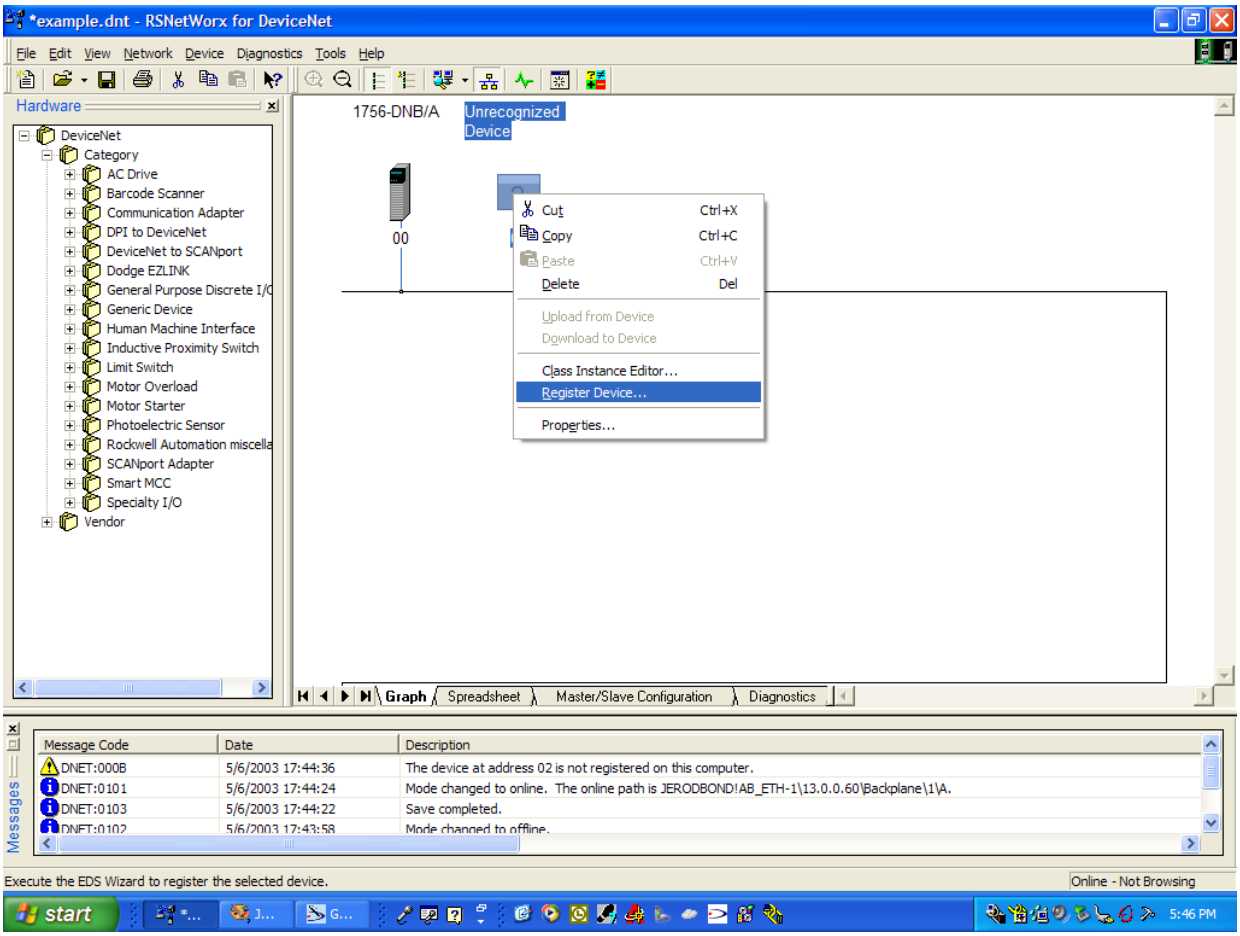


Fig. 9

Choose Register an EDS file. (Fig. 10)

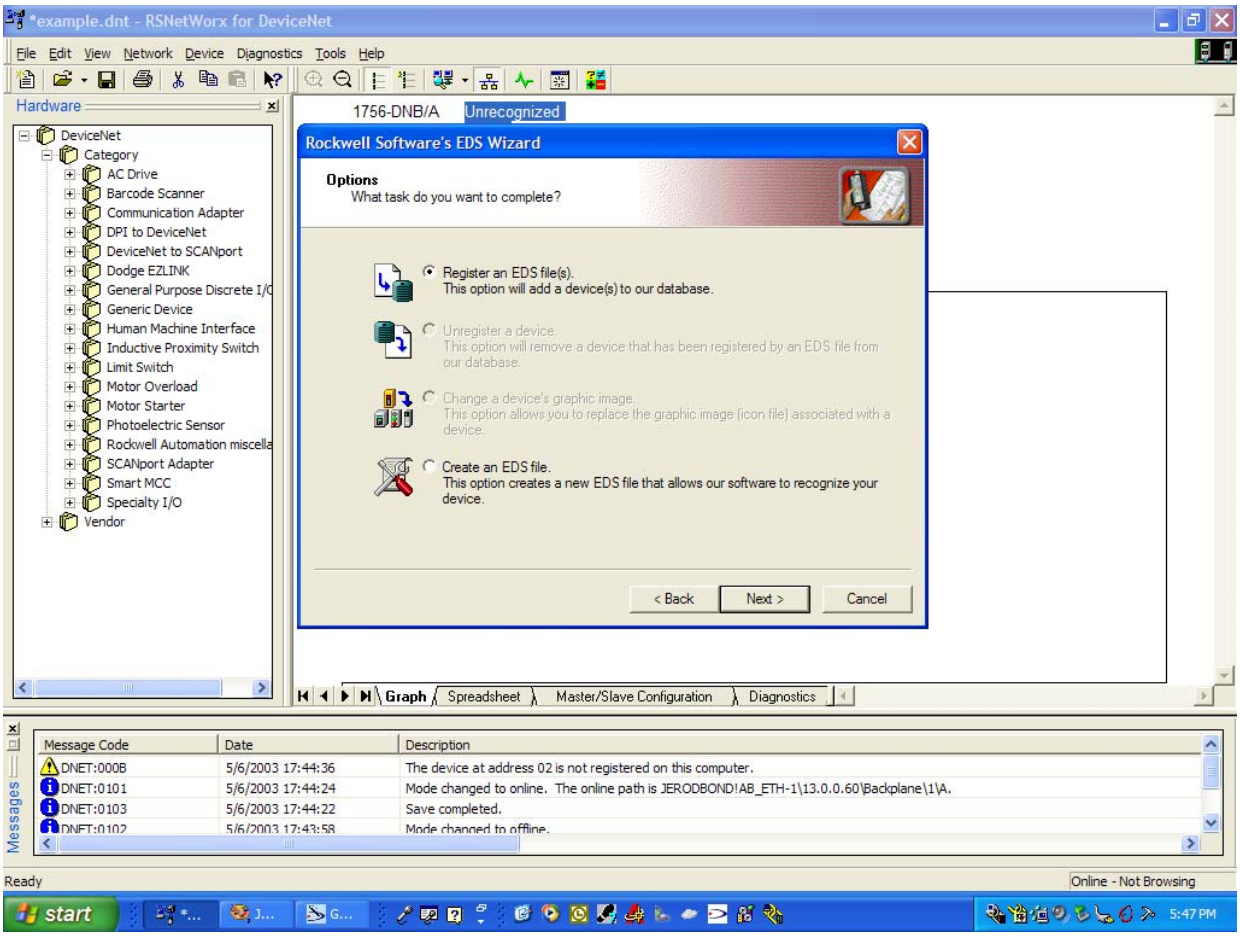


Fig. 10

Point the program to the DS6300.eds file. (Fig. 11)

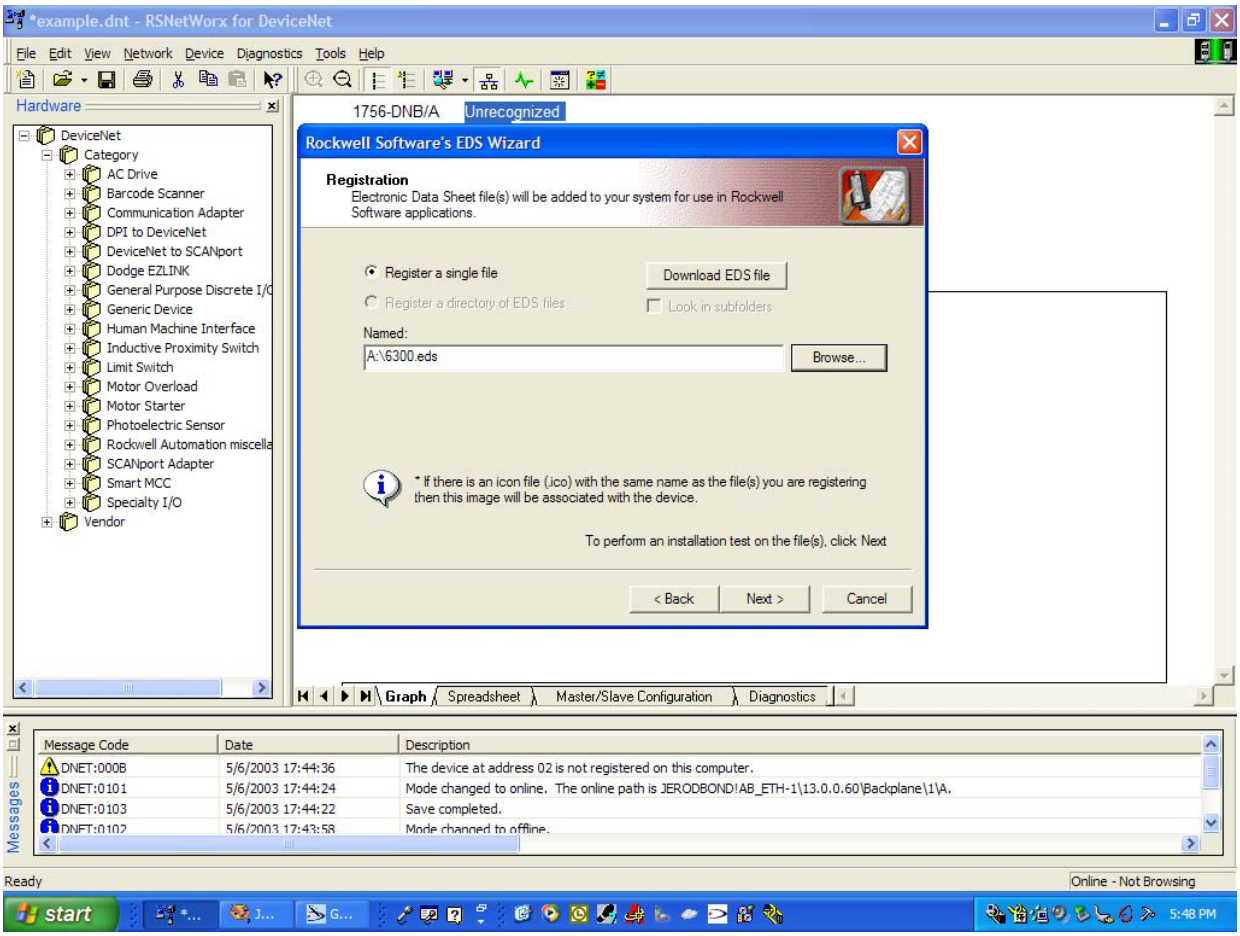


Fig. 11

The DS6300 is now registered. (Fig. 12)

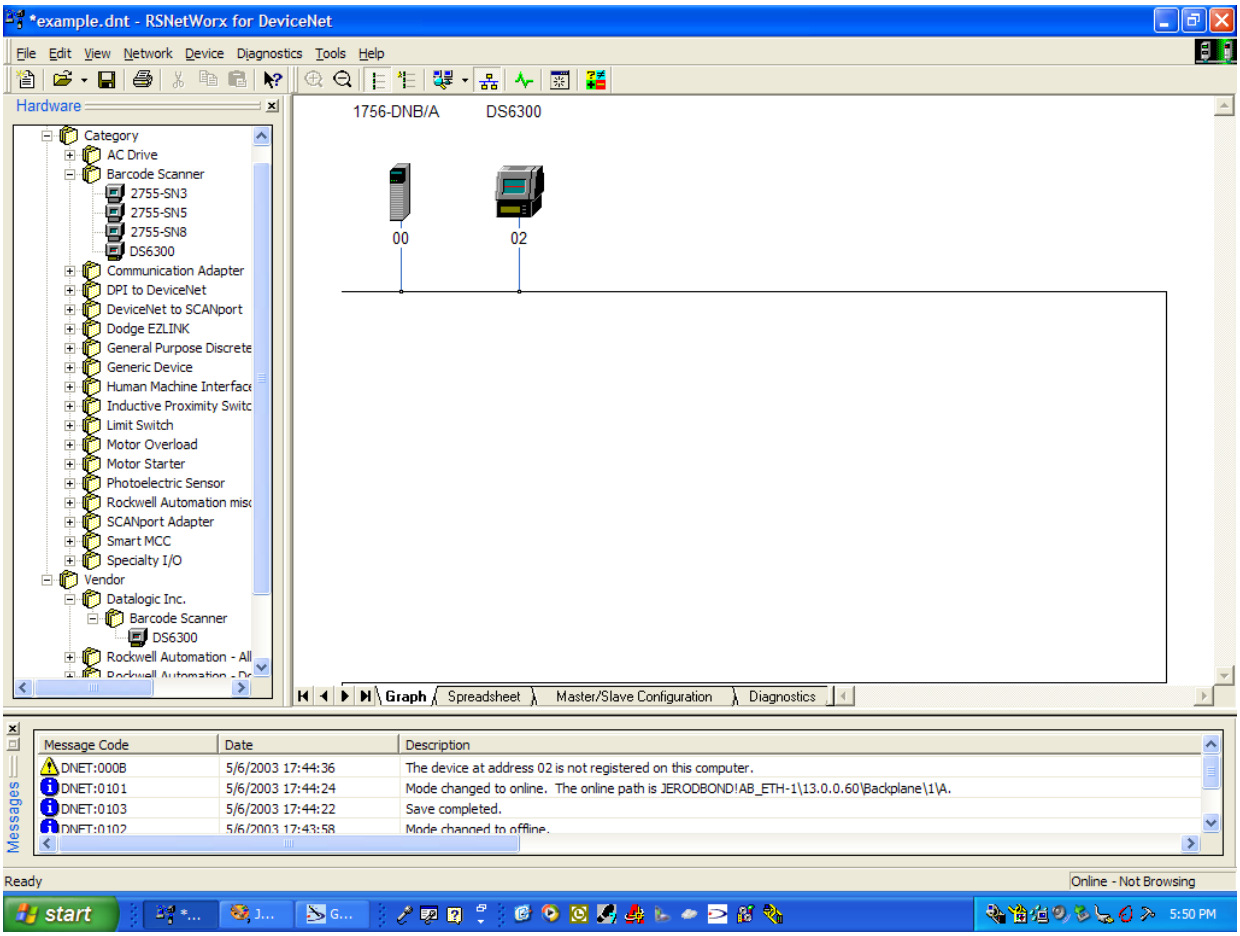


Fig. 12

2.3.2 Set I/O Image size, Protocol, and Map Data

Double click on the DNB module. If you are online choose upload from the scanner when prompted.

Choose the **Module Tab (**Fig 14)

It is recommended to put the DS6300 on a background poll. This device does not need polled 100 times a second. An interscan of 100ms is recommended.
At 500K baud an interscan delay of at least 80ms is required.

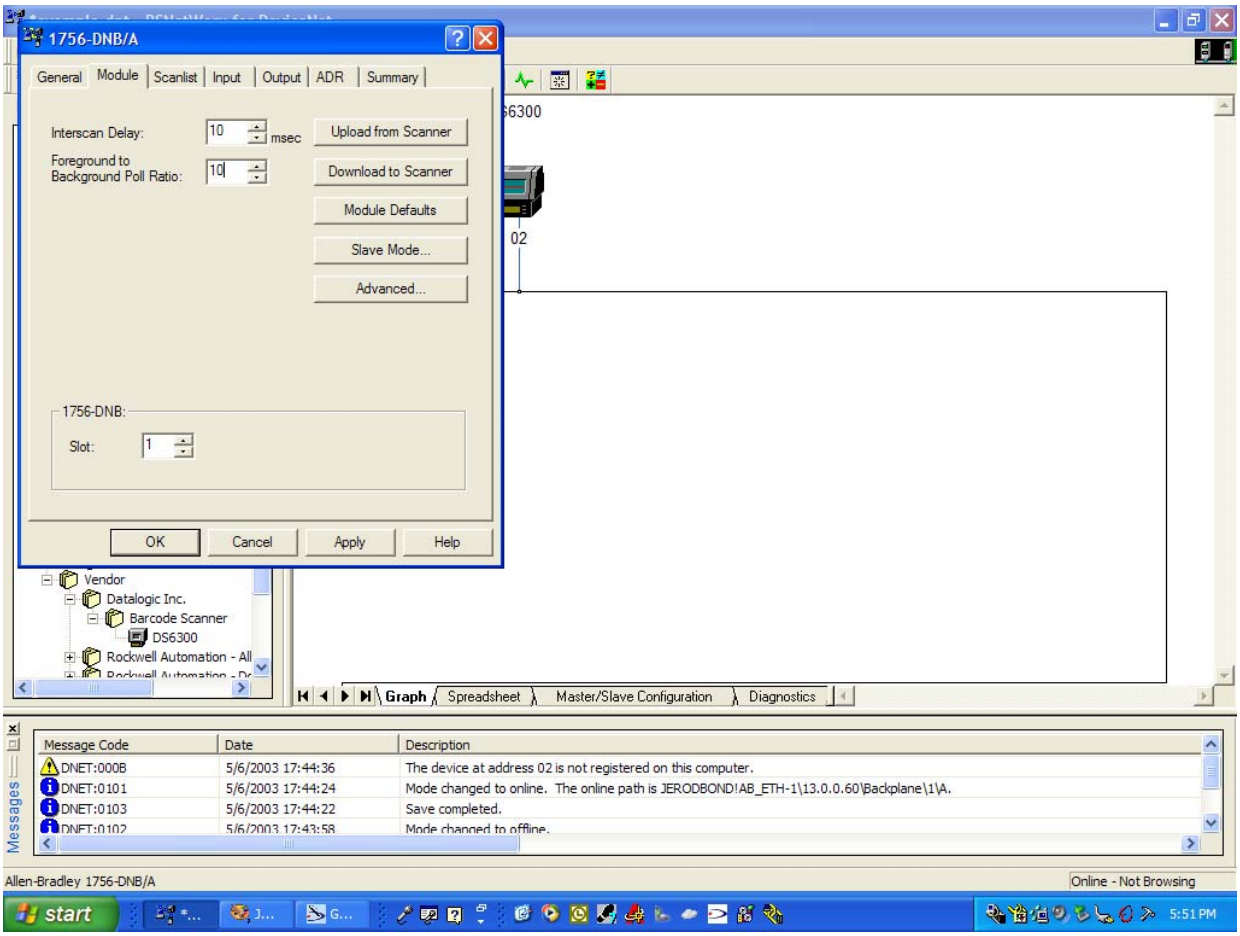


Fig. 13

Choose the **Scanlist Tab** (Fig. 14)

Move the Ds6300 into the scanlist.
Choose the Edit I/O parameters button.

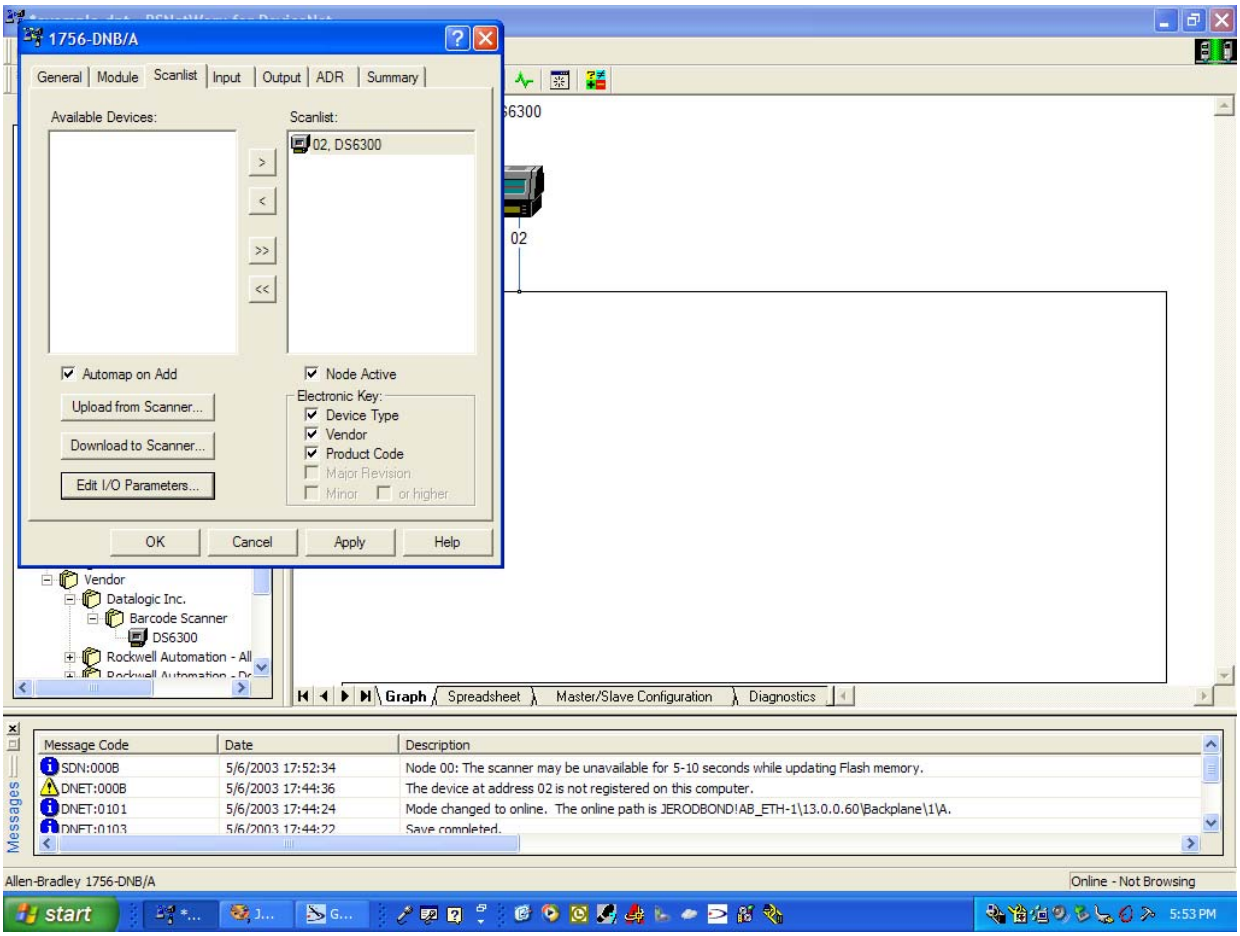


Fig. 14

Make sure the input size is the same as the TX Msg size of the DS6300
Make sure the output size is the same as the RX Msg size of the Ds6300
Put the scanner on the background poll
Make sure COS and Strobed are not checked

Click OK (Fig. 15)

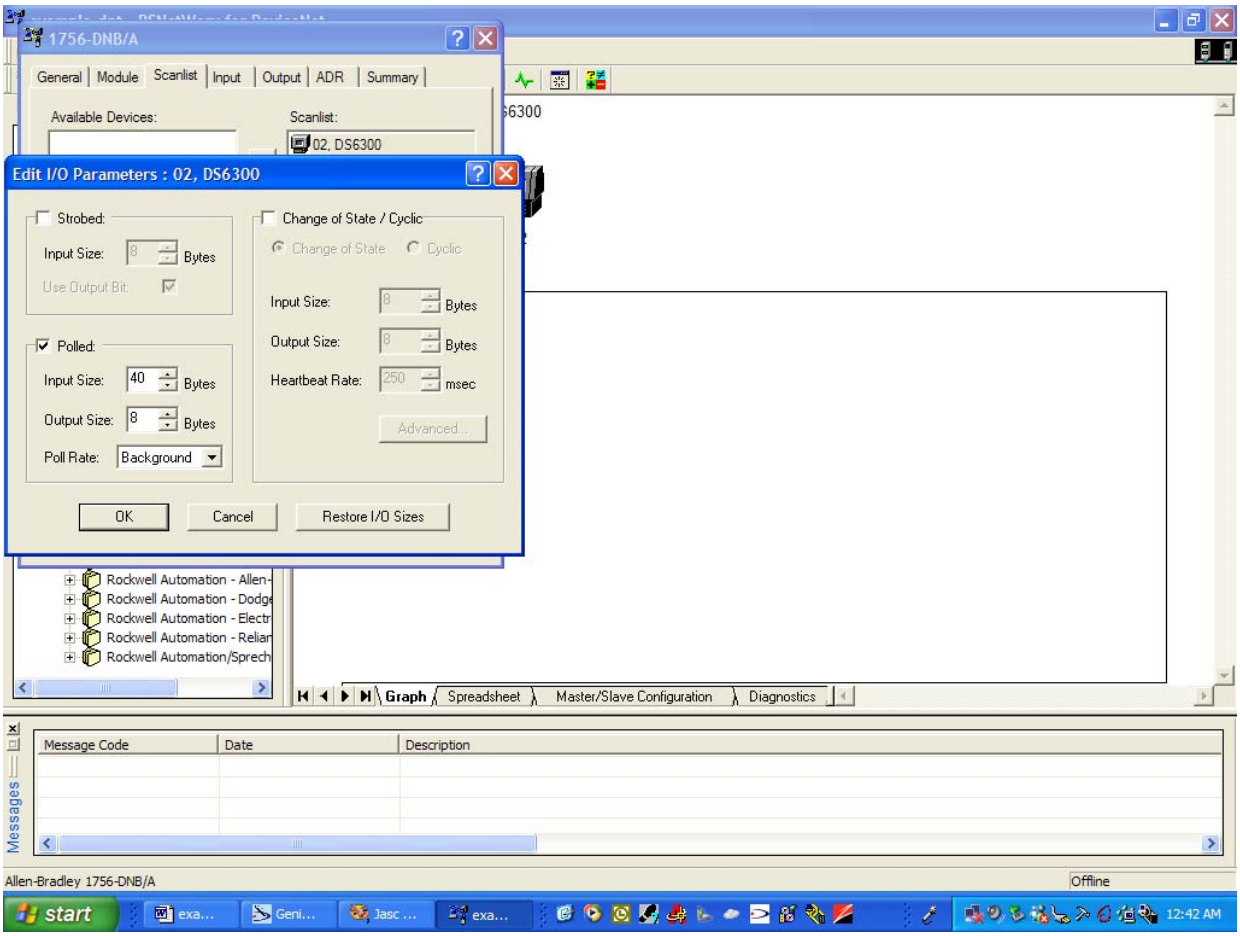


Fig. 15

Choose the **Input tab** (Fig. 16)

If you used Automap there is nothing to do here.
These are the locations in the PLC input table where the data will be mapped

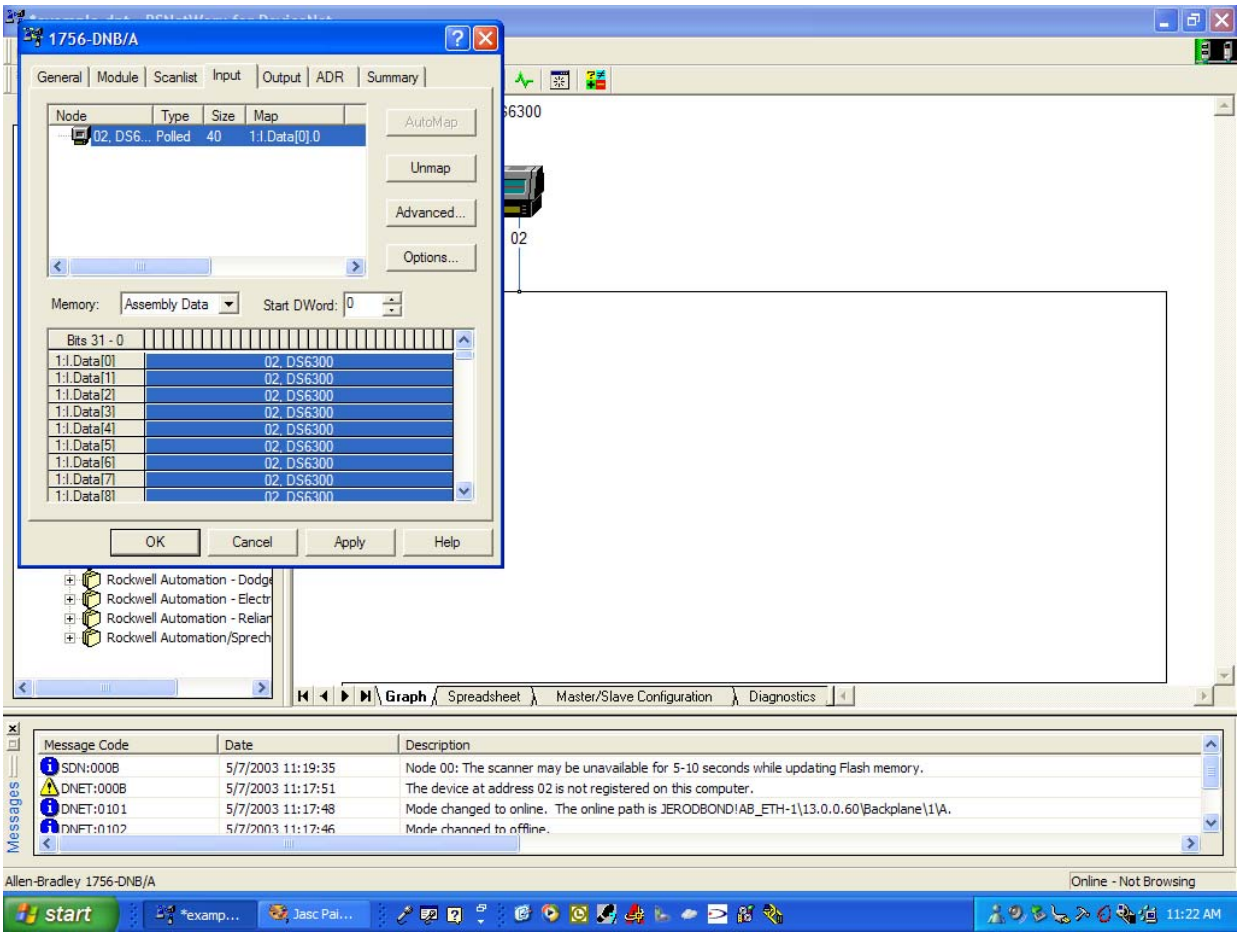


Fig. 16

Choose the **Output tab** (Fig. 17)

If you used Automap there is nothing to do here
These are the locations in the PLC output table where the data will be mapped.

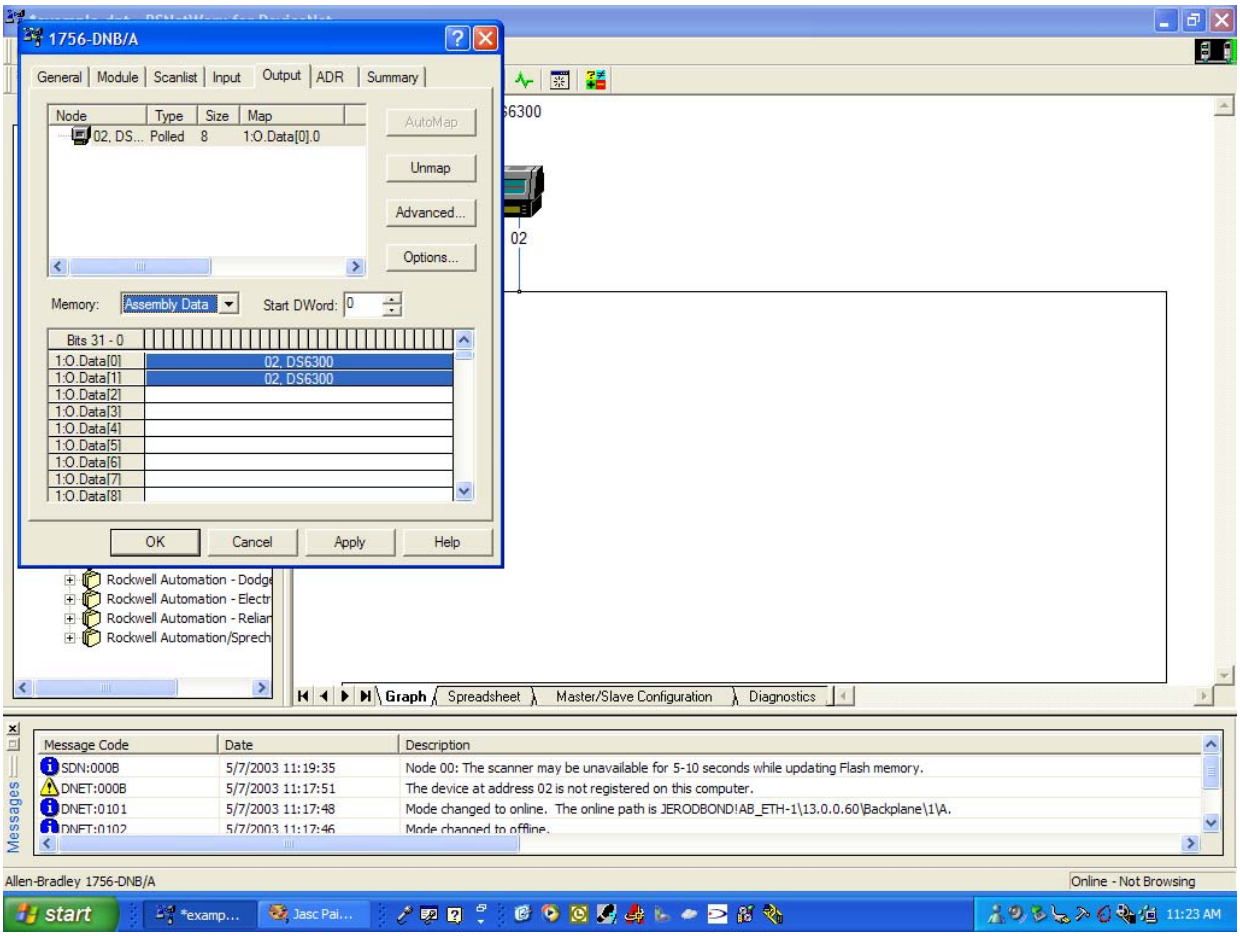


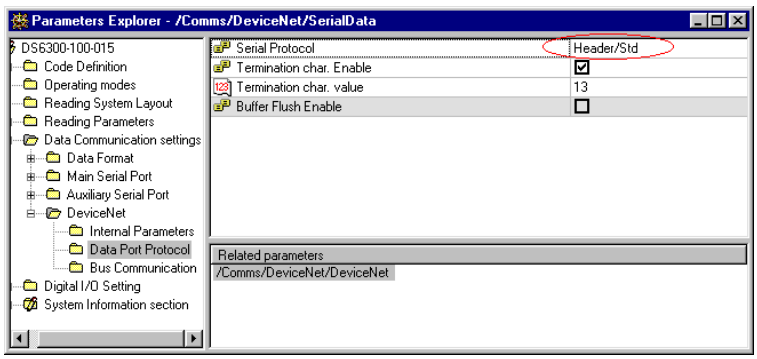
Fig. 17

Click on apply to download to the 1756-DNB. If all was done correctly, the light on the DNB should be solid green. No error messages on the screen. Idle is OK

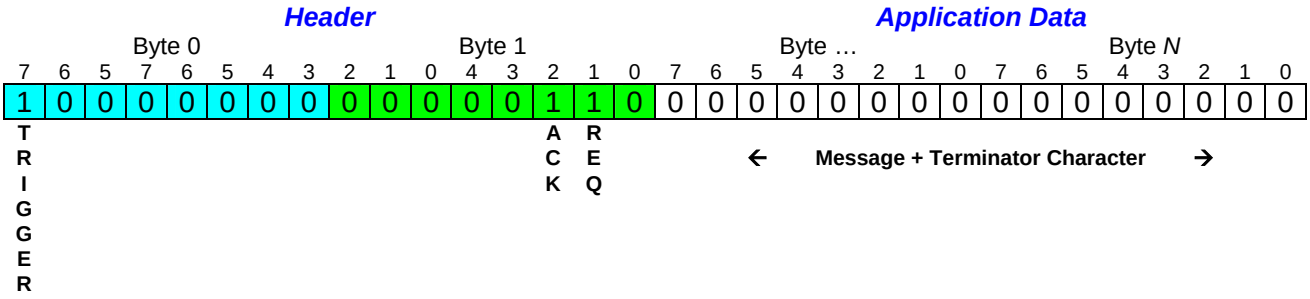
Download the example ladder to the processor and run it.

2.4 Triggering and Handshake Basics

Following Message Structure refers to *Serial Protocol* = *Header/Std* (default).



Header is a WORD mapped in first 2 Byte of Input/Output area.
Application message starts from 3rd Byte.



According to the previous settings,
the DS6300 reading phase begins when Bit 7 in 1st Byte (Byte0) of the Output area is set.
The DS6300 reading phase ends when Bit 7 in 1st Byte (Byte0) of the Output area is reset.

The handshake for receiving the barcode data is as follows:

1) When data is available, Bit 1 (REQ) will be set set in 2nd Byte (Byte1) of Input area.

2) Upon seeing this bit the ControlLogix should get the data and move it to wherever it is needed.

3) ControlLogix should then set output image Bit 2 (ACK) set in 2nd Byte (Byte1) of Output area.
This tells the DS6300 that it is done with the data.

4) The DS6300 will reset input image Bit 1 (REQ) in 2nd Byte (Byte1) of Input area in response.

5) The ControlLogix should then reset Bit 2 (ACK) in in 2nd Byte (Byte1) of Output area.

6) Cycle is now complete and it can be repeated from point 1).

2.4.1 Input Image

The table below represents the ControlLogix Input image for the DS6300.
Notice the barcode 06DL from the test chart was placed in the table.

	Input Image																													
	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Dword:0	D				6				0				<STX>				TRIG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ACK	REQ	Sens
Dword:1																									<CR>				L			
Dword:2																																
Dword:3																																
Dword:4																																
Dword:5																																
Dword:6																																
Dword:7																																
Dword:8																																
Dword:9																																

2.4.2 Output image

The table below represents the ControlLogix output image for the DS6300.

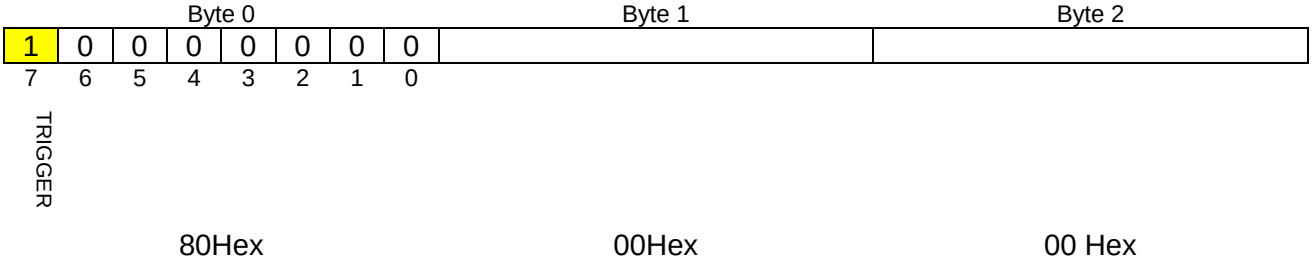
	Output Image																													
	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Dword:0																	TRIG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ACK	REQ	Sens
Dword:1																																

2.5 Example

2.5.1 Reading Phase Activation

Set bit 7 of 1st byte in the Output area.

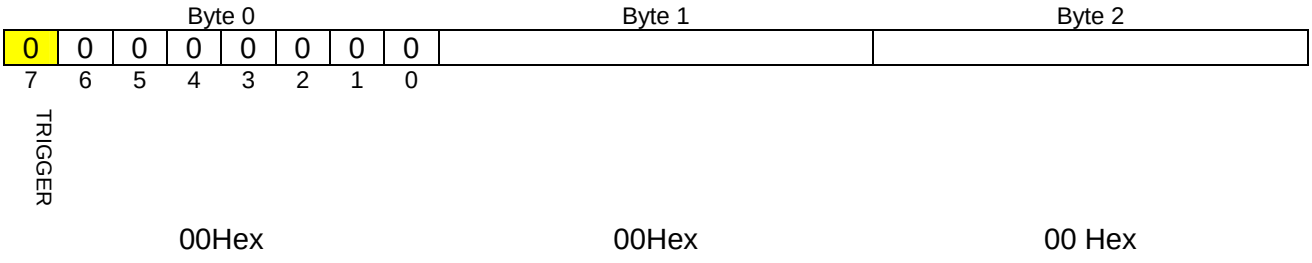
PLC → DS6300
Output Area



2.5.2 Reading Phase Deactivation

Reset bit 7 of 1st byte in the Output area.

PLC → DS6300
Output Area

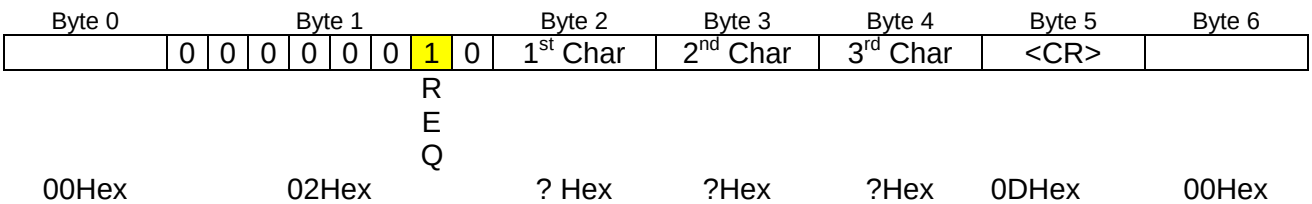


2.5.3 Reading Phase Result

As default, data are sent to PLC as soon as you read a barcode. No Read happens only at the end of the reading phase.

1) When data is available, Bit 1 (REQ) will be set in 2nd Byte (Byte1) of Input area.

DS6300 → PLC
Input Area



2) Upon seeing this bit the ControlLogix should get the data and move it to wherever it is needed.

3) ControlLogix should then set output image Bit 2 (ACK) set in 2nd Byte (Byte1) of Output area. This tells the DS6300 that it is done with the data.

PLC → DS6300
Output Area

Byte 0	Byte 1								Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
	0	0	0	0	0	1	0	0					
						ACK							
00Hex	04Hex								00Hex	00Hex	00Hex	00Hex	00Hex

4) The DS6300 will reset input image Bit 1 (REQ) in 2nd Byte (Byte1) of Input area in response.

DS6300 → PLC
Input Area

Byte 0	Byte 1								Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
	0	0	0	0	0	0	0	0	1st Char	2nd Char	3rd Char	<CR>	
							REQ						
00Hex	00Hex								? Hex	?Hex	?Hex	0DHex	00Hex

5) The ControlLogix should then reset Bit 2 (ACK) in in 2nd Byte (Byte1) of Output area.

PLC → DS6300
Output Area

Byte 0	Byte 1								Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
	0	0	0	0	0	0	0	0	1st Char	2nd Char	3rd Char	<CR>	00
						ACK							
00Hex	00Hex								? Hex	?Hex	?Hex	10Hex	00Hex

6) Cycle is now complete and it can be repeated from point 1).

2.6 DeviceNet Master Simulator

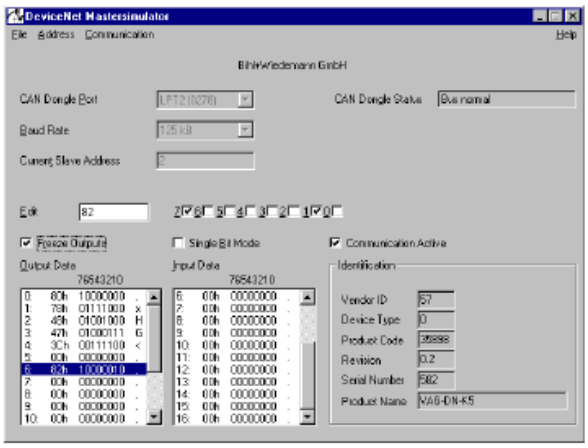
In order to provide a further (first level) support please take the opportunity to consider the following device:

DeviceNet Master Simulator

Bihl + Wiedemann

Automatisierungstechnik

Monitoring Software for DeviceNet Slaves



DeviceNet Dongle with USB Interface (Art. no. BW1420)

DeviceNet Dongle with Parellel Port (Art. no. BW1255)

Article no. BW1420 with USB interface

Article no. BW1255 with parallel port

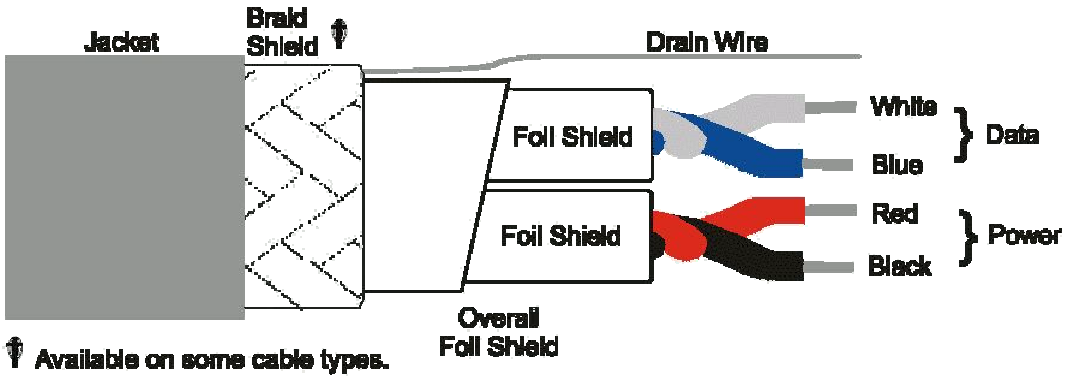
See details starting from this link:
http://www.bihl-wiedemann.com/englisch/catalog/12551420.html

3. Appendix

3.1 Cabling

Thin cable → Max 100 (m)
Thick cable → Max 500 (m)

DeviceNet™ – Thick Cable Specifications



3.2 Connectors

Popular 'Mini' 18mm and 'Micro' 12mm waterproof quick-disconnect plugs and receptacles, and 5 pin phoenix terminal block.

Mini 18 mm

Micro 12 mm

3.3 Network Specifications

<table>
<tr><td>Topology</td><td>Trunk line with drops and/or branches</td></tr>
<tr><td>Cabling</td><td>Two separate shielded twisted pairs contained in one shielded cable; May be thick trunk, thin trunk or flat cable</td></tr>
<tr><td>Base Technology</td><td>CAN (Controller Area Network)</td></tr>
<tr><td>Number of Devices</td><td>64 per network</td></tr>
<tr><td>Data Delivery</td><td>8 bytes of data for I/O; may be unlimited if rolled over.</td></tr>
<tr><td>Power</td><td>Thick Cable 8 Amps @ 24 VDC
Thin Cable 4 Amps @ 24 VDC</td></tr>
<tr><td>Cable Length (Thick)</td><td>
<table>
<tr><td>Data Rate</td><td>Trunk Length</td><td>Maximum Drop</td><td>Cumulative Drop</td></tr>
<tr><td>125 Kbaud</td><td>500m (1,640 ft)</td><td>6m (20 ft)</td><td>156m (512 ft)</td></tr>
<tr><td>250 Kbaud</td><td>250m (820 ft)</td><td>6m (20 ft)</td><td>78m (256 ft)</td></tr>
<tr><td>500 Kbaud</td><td>100m (328 ft)</td><td>6m (20 ft)</td><td>39m (129 ft)</td></tr>
</table>
</td></tr>
<tr><td>Cable Length (Thin)</td><td>100m (328 ft)</td></tr>
<tr><td>Communication Method</td><td>Master/Slave, explicit and solicited messaging; Unsolicited messaging, multi-master and peer to peer.</td></tr>
<tr><td>Data Signal</td><td>Square wave digital with non return to zero encoding</td></tr>
<tr><td>Error Detection</td><td>Automatic retransmission of corrupted messages and autonomous switch off of defective nodes.</td></tr>
<tr><td>Address Setting</td><td>Off-line via hand held. On-line via master using a reserved newcomer default address that is changed to an application address.</td></tr>
<tr><td>Support Organization</td><td>Open DeviceNet Vendor Association: http://www.odva.org/</td></tr>
</table>

4. Troubleshooting

	• Once you have modified the DeviceNet parameters, remember to set DeviceNet → Internal Parameters → Parameters Update so the new configuration will be loaded into DeviceNet card while restarting.
	• Make sure DeviceNet → Bus Communication → Data Rate of DeviceNet board in Genius matches network speed in PLC.
	• Make sure DeviceNet → Bus Communication → Data Rate of DeviceNet board in Genius matches network speed in PLC
	• If DeviceNet → Bus Communication → Data Port Protocol = Header/Std or Header/Rev make sure DeviceNet → Bus Communication → Rx Msg Size is greater than 1